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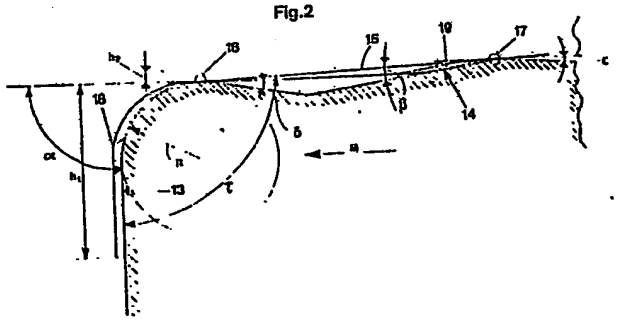
(54) Cutting insert.

(57) The present invention relates to a cutting insert for chip removing machining, preferably turning or drilling, said cutting insert (10;10a) has at least one cutting corner including a main cutting edge (13) having a setting angle (α).

The invention has the aim of disclosing a cutting insert that simultaneously carries out rough and finishing machining alternatively finishing machining and polishing. By this way one or more separate working moments are eliminated.

Characterizing for the cutting insert according to the invention is that behind the main cutting edge, seen in the direction of the feeding direction (M) of the cutting insert (10;10a), is arranged a further cutting edge (14;14a,14b) and/or a burnishing means. An included angle (τ) between the straight portion of the main cutting edge (13) and a line that touches the cutting corner and passes through an end of the further cutting edge (14;14a,14b) located furthest away from the main cutting edge (13). The setting angle (α) and the angle (τ) together have a value within the interval 177° - 210°, preferably 177° - 195°.

Fig.2



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Description

Cutting insert

The present invention relates to a cutting insert for chip removing machining, preferably turning or drilling, said cutting insert having at least one cutting corner including a main cutting edge.

In e.g. turning, machining according to prior art normally is carried out by one or more cutting inserts for rough machining. The machining is completed by a finishing cutting insert. This is necessary since the roughly turned surface not has a sufficient finish and roundness.

It is at once realized that such a machining in several steps using different tools is both expensive and time-consuming.

The present invention has the aim of disclosing a cutting insert of the type defined above, said cutting insert in e.g. longitudinal turning simultaneously carries out roughing and finishing cut alternatively finishing cut and polishing alternatively roughing and finishing cut and polishing.

The aim of the present invention is realized by a cutting insert that has been given the characteristics of the appending claims.

Embodiments of the invention will be described below, reference being made to the accompaning drawings where Fig.1 shows a cutting insert according to the invention in operative position in longitudinal turning; Fig.2 shows a detail of the cutting insert according to Fig.1; Fig.3 shows the radial forces that act upon the cutting insert in longitudinal turning; Fig.4 shows the radial forces in an alternative embodiment of the cutting insert according to the invention; Fig.5 shows a diagram of the variation of the surface finish relative to the feed speed of a cutting insert according to the invention compared to a conventional cutting insert; Fig.6 shows an alternative embodiment of a cutting insert according to the present invention; and Fig.7 shows a cutting insert according to the invention mounted in a short hole drill.

The cutting insert 10 schematically shown in Fig.1 has in the disclosed embodiment a triangular basic shape. However, within the scope of the invention it is possible to have other basic shapes, e.g. rombic.

The indexable insert 10 is mounted in a holder (not shown). A workpiece 11 is machined by the indexable insert 10, said workpiece 11 being rotated around its longitudinal centre axis 12. The feeding direction of the insert 10 is axis designated by M.

The encircled portion A of Fig.1 is shown more in detail in Fig.2.

As can be learnt from Fig.2 the indexable insert 10 includes at least one cutting corner having a main cutting edge 13 and a secondary cutting edge 14.

In the disclosed embodiment the straigth portion of the main cutting edge 13 has a setting angle α of 90°. The clear angle δ can vary within relativly wide limits. In the disclosed embodiment $\delta \approx 5°$. The cutting depth for the main cutting edge is designated by h_1 and the nose radius is designated by R. The magnitude of the nose radius should be in the interval of 0.2 - 3.2 mm.

The cutting depth h_2 of the secondary cutting edge 14 is smaller than 0.5 mm and preferably in the magnitude of 0.03 mm. In this connection it should be pointed out that if the main cutting edge 13 produces a rough machined surface having a distinct wave shape it is possible within the scope of the invention to have a negative cutting depth of the secondary cutting edge, i.e. the peaks of the waves are not completely removed.

The setting angle of the secondary cutting edge 14 is designated by β and should have a magnitude of 3° although also bigger setting angles are possible.

The clear angle E of the secondary cutting edge 14 should be smaller than 2°. In the disclosed embodiment $\varepsilon \approx 15'$.

In Fig.2 is also drawn a line 15 that touches the cutting corner in a point 16 and also passes through the end point 17 of the secondary cutting edge 14 being located furthest away from the main cutting edge 13. Said line 15 is denominated machining line. The angle that is included between said line 15 and the straight portion of the main cutting edge 13 is designated by τ.

The length of the line 15 between the points 16 and 17 is within the interval 0.1 - 4 mm, preferably 0.5 - 2 mm, e.g. 1 mm.

As is appearant from Fig.3 the radial feeding forces F_1' and F_1'' acting upon the main cutting edge 13 and the secondary cutting edge 14 are small. This means that the reaction forces acting upon the insert 10 are small.

By viewing Fig.3 it is realized that the smaller the nose radius R is the smaller is the radial force F_1'. When it comes to the radial force F_1'' the setting angle β of the secondary cutting edge 14 is indeed small relatively seen. However, also the cutting depth h_2 of the cutting edge 14 is small. This means that the magnitude of the radial force F_1'' is relatively seen small.

As is appearant from Fig.4 the invention is also applicable for an insert having a setting angle α different from 90°. If the setting angle is smaller than 90° a bigger radial force F_1 for the main cutting edge 13 is achieved. Within the scope of the invention it is also possible that the setting angle α of the main cutting edge 13 is somewhat bigger than 90°. In such a case the radial forces acting upon the straight portion of the main cutting edge 13 compensate the radial forces acting upon the curved portion of the main cutting edge and/or the radial forces acting upon the secondary cutting edge.

According to the invention the angle τ and the setting angle α together have a value within the interval of 177° - 210°, preferably 177° - 195°.

The cutting insert according to the present invention functions in the following way.

In longitudinal turning, see Fig.2, a chip 18 of normal appearance is achieved at the main cutting edge 13 while the secondary edge 14 produces a very thin chip 19. At a feeding speed of 0.2 mm per

revolution a primary chip 18 of about 0.2 mm's thickness is received while the secondary chip 19 only is 0.02 xm thick. This in combination with a relatively seen small clear angle of the secondary cutting edge 14 brings about that the surface finish when using a cutting insert according to the present invention is essentially improved compared to a conventional cutting insert.

In this connection it should be noted that the principal of design including a secondary cutting edge brings about that the surface finish is far more independent of the feed speed per revolution than for conventional cutting inserts. Field tests have shown that for a feeding of 0.8 mm per revolution a satisfactory surface finish is achieved by using the principals of the present invention. This means that the tool wear, measured by the number of machined details, will decrease to an essential degree.

In Fig.5 a diagram is disclosed. From said diagram the improved surface finish, in the form of the average surface deviation "R_a", can be learnt for a cutting insert according to the present invention compared to a conventional cutting insert for different feed speeds "S".

As is appearant from the diagram according to Fig.5 a drastic improvement of the surface finish is achieved, especially for high feed speeds.

The embodiment shown in Fig.6 of a cutting insert 10a according to the invention is modified compared to the cutting insert 10 described above by having two secondary cutting edges 14a, 14b provided behind the main cutting edge 13, seen in the feeding direction M. As can be seen from Fig.6 the setting angles β_a and $\beta_b \approx 3°$ for both secondary cutting edges 14a, 14b. Preferably the secondary cutting edge 14b can have a further cutting depth of 1/100 mm compared to the secondary cutting edge 14a.

The angles τ_a and τ_b are included between the straight portion of the main cutting edge 13 and the machining lines 15a and 15b resp.

When more than one secondary cutting edge is arranged the above given values for the clear angle ε are most pertinent for the secondary cutting edge located furthest away from the main cutting edge.

Within the scope of the invention more than two secondary cutting edges are possible.

Within the scope of the invention it is also possible that the secondary edge has no cutting function but only a polishing function. In that case it is denominated burnishing means. It is of course also possible to arrange in a cutting corner one or more secondary cutting edges in combination with one or more burnishing means.

In the embodiment of Fig.7 a short hole drill 20 is shown. Said drill is provided with a radially inner cutting insert 21 and a radially outer cutting insert 22. A detail in an enlarged scale of the radially outer cutting insert 22 is shown in Fig.7.

In a corresponding way to the embodiments described above the radially outer cutting insert 22 has a cutting corner including a main cutting edge 13 and a secondary cutting edge 14. The line that touches a point 16 in the cutting corner and passes through the end point 17 of the secondary cutting edge 14 that is located furthest away from the main cutting edge 13 is designated by 15 and denominated machining line.

The included angle between the main cutting edge 13 and the machining line 15 is denominated τ. The setting angle is denominated α. According to the invention the angle τ and the setting angle α together have a value within the interval 177° - 210°, preferably 177° - 195°.

The length of the machining line 15, between the points 16 and 17, is within the interval 0.1 - 4 mm, preferably 0.5 -2 mm, e.g. 1 mm.

The invention is applicable both for positive and negative cutting inserts.

Claims

1. Cutting insert for chip removing machining, preferably turning or drilling, said cutting insert (10) including at least one cutting corner with a main cutting edge (13) having a setting angle (α),
characterized in that behind the main cutting edge (13), seen in the feeding direction (M) of the cutting insert (10), a further cutting edge (14;14a,14b) and/or a burnishing means is provided.

2. Cutting insert according to claim 1,
characterized in that an included angle (τ; τ_a, τ_b) is located between the straight portion of the main cutting edge (13) and a line (15;15a,15b) that touches the cutting corner in a point (16) and passes through an end point (17) of the further cutting edge or the burnishing means, said end being located furthest away from the main cutting edge (13), the setting angle (α) and the angle (τ) together have a value within the interval 177° - 210°, and that the distance between the touching point (16) of the cutting corner and the line (15) and the intersection point (17) between the line (15) and the secondary cutting edge (14;14a,14b) is in the interval 0.1 - 4 mm.

3. Cutting insert according to claim 2,
characterized in that the setting angle (α) and the angle (τ) together have a value within the interval 177° - 195°, and that the distance between the points (16) and (17) is within the interval 0.5 - 2 mm.

4. Cutting insert according to any of the preceeding claims,
characterized in that several further cutting edges (14;14a,14b) and/or burnishing means are provided behind the main cutting edge (13) seen in the feeding direction (M).

5. Cutting insert according to any of the preceeding claims,
characterized in that the clear angle (E) of the further cutting edge (14;14b)/burnishing means located furthest away from the main cutting edge (13) is less than 2°.

6. Cutting insert according to any of the preceeding claims,

characterized in that the setting angle ($\beta;\beta_a,\beta_b$) of the further cutting edge (14;14a,14b) is in the magnitude of 3°.

7. Cutting insert according to any of the preceeding claims,
characterized in that the nose radius for the cutting corner is within the interval 0.2 - 3.2 mm.

8. Cutting insert according to any of the preceeding claims,
characterized in that the cutting corner including the further cutting insert (14;14a,14b)/burnishing means is arranged in a bevelled portion of the basic shape of the cutting insert.

9. Cutting insert according to any of the preceeding claims,
characterized in that the cutting depth (h_2) of the secondary cutting edge (14) is smaller than 0.5 mm.

10. Cutting insert according to claim 9,
characterized in that the cutting depth (h_2) is negative.

Fig.1

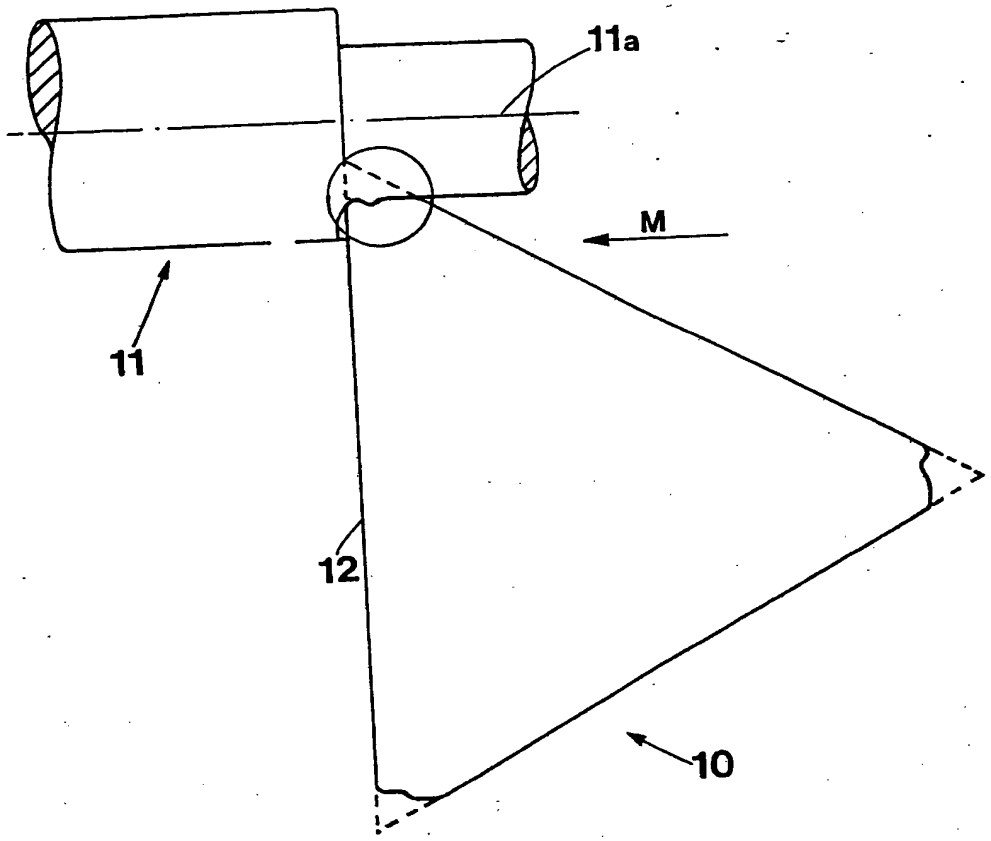


Fig.3

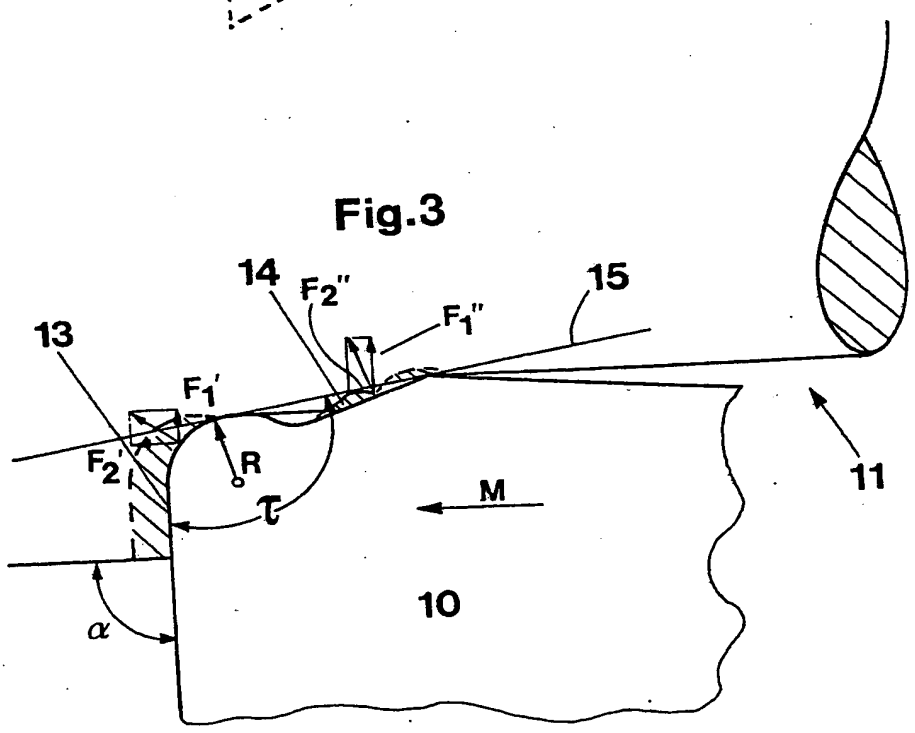


Fig.2

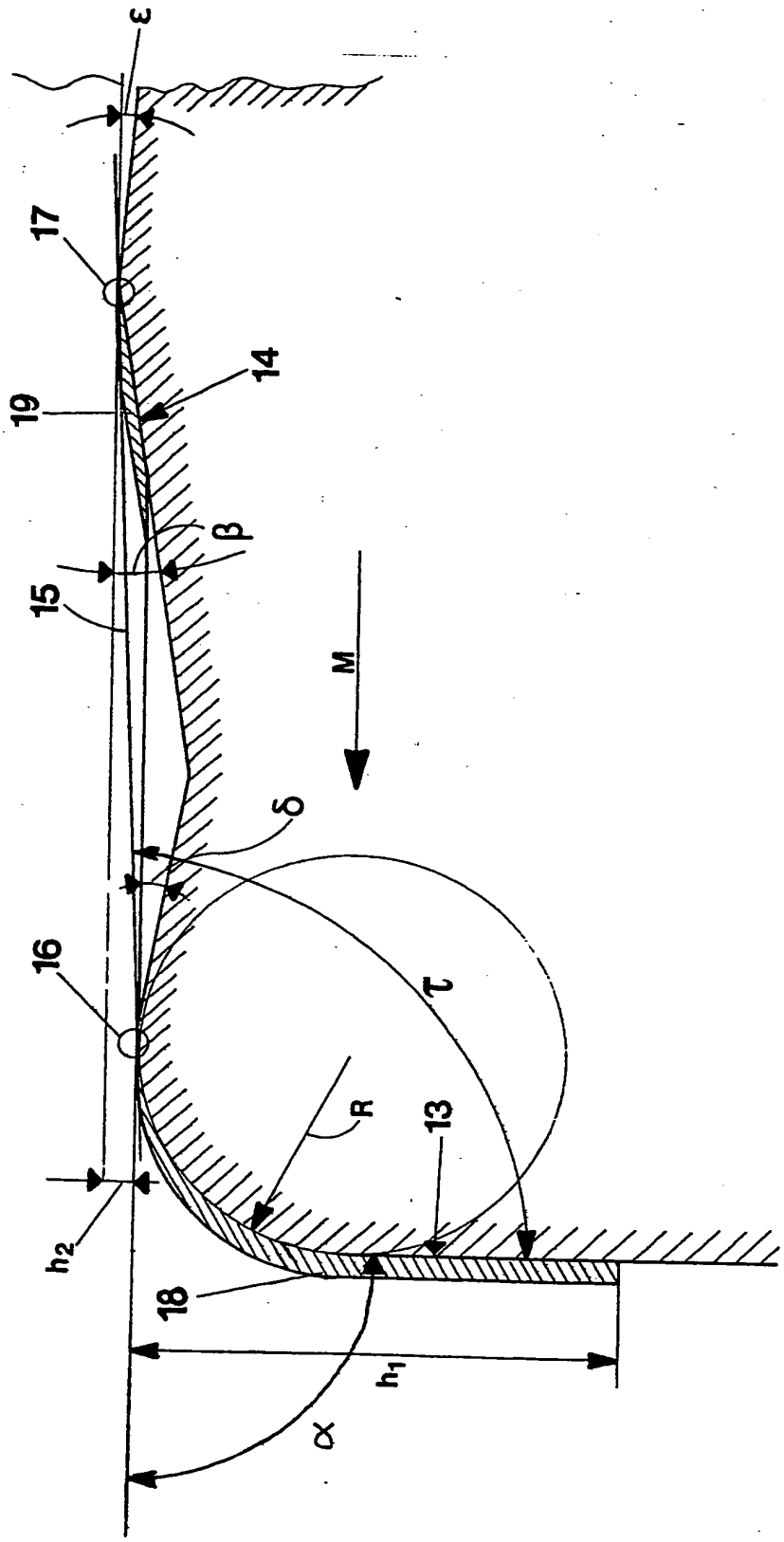


Fig.4

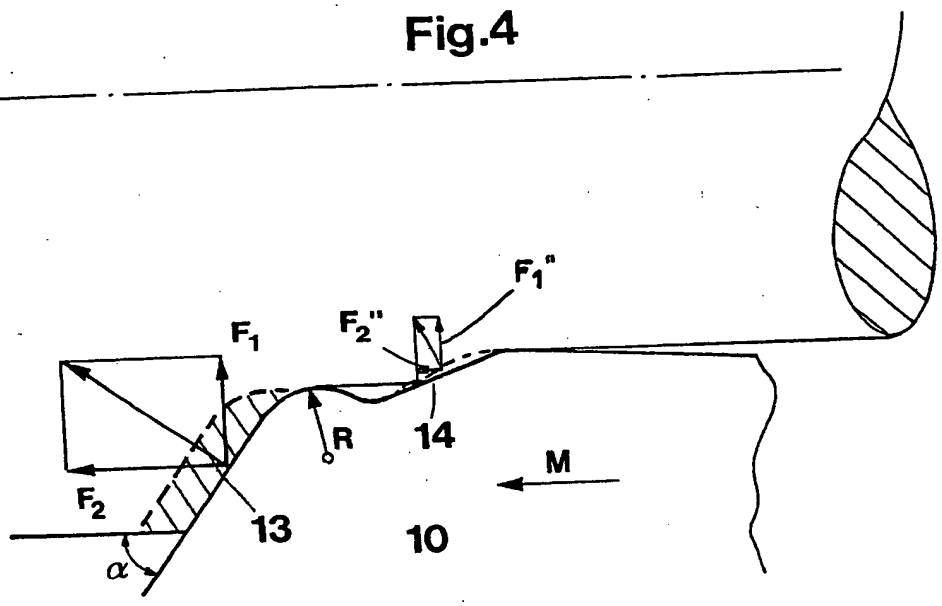


Fig.6

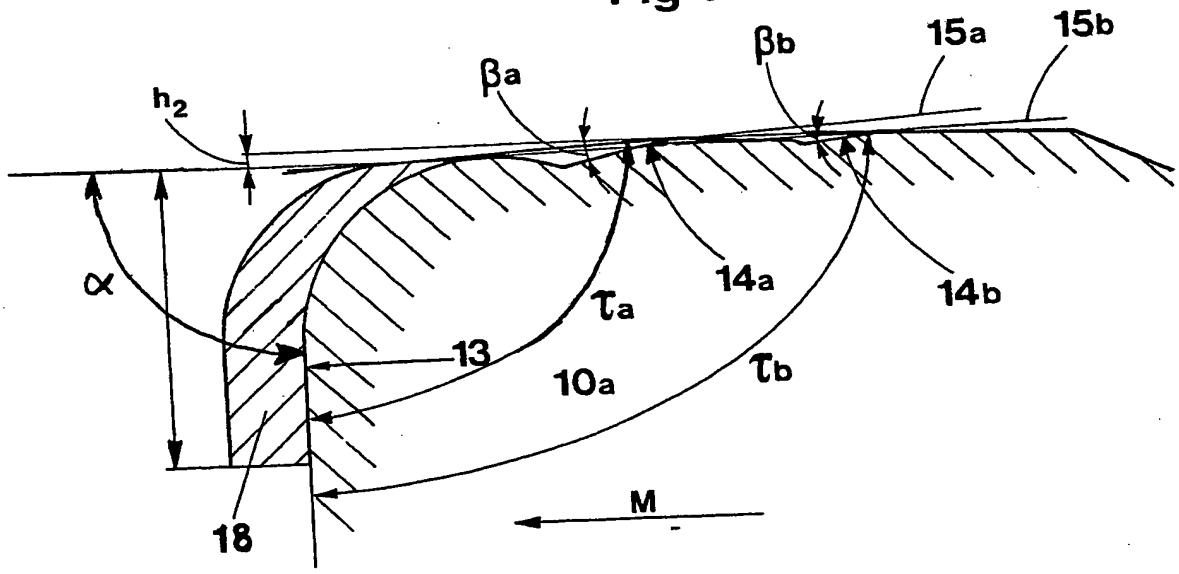


Fig.5

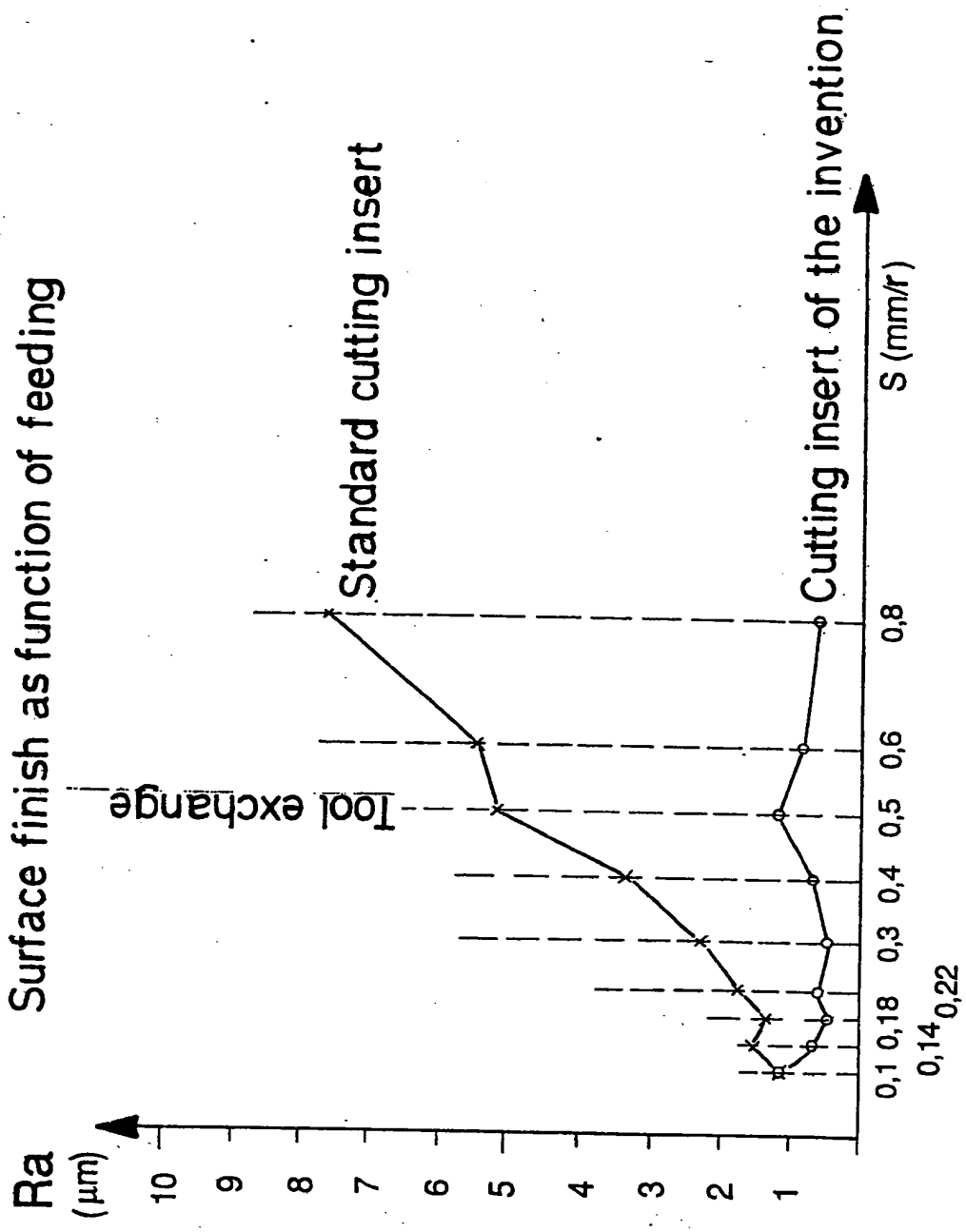
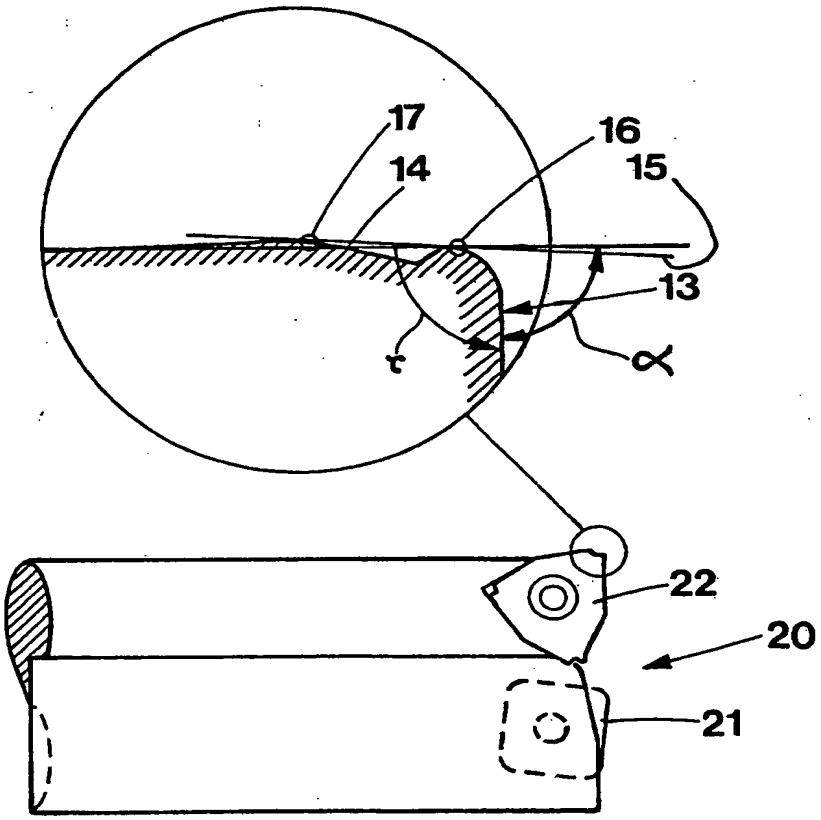

Surface finish as function of feeding
Ra (µm)
10
9
8
7
6
5
4
3
2
1
Standard cutting insert
Tool exchange
Cutting insert of the invention
S (mm/r)
0,1 0,18 0,3 0,4 0,5 0,6 0,8
0,14 0,22

Fig.7



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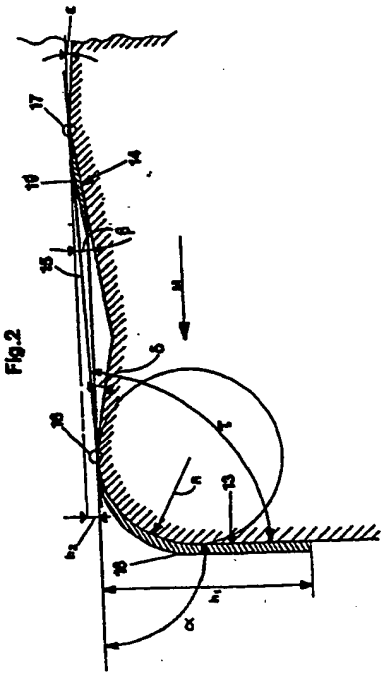

Fig.2

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EUROPEAN SEARCH REPORT

Application Number

EP 88 85 0342

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-2 610 097 (SCHUBERT & SALZER MASCHINENFABRIK AG) * Pages 5-7; figures *	1	B 23 B 27/14
A		2,3,5-10	
X	GB-A-2 095 140 (TECHNO ARBED) * Claims; figures *	1	
X	FR-A-2 428 491 (ROCHLING-BURBACH WEITERVERARBEITUNG GmbH) * Claim 1; figures *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)
B 23 B 27/00 B 23 C 5/00 B 23 B 51/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-03-1990	BERGSTROEM J.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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